development. Around 60% of the 38.000 new cancer patient will have a treatment in a radiotherapy department. Based on the figures of the Austrian Cancer registrations the cancer prevalence will increase dramatically in the near future based on the demographic trend, general increased expectation of life in combination with the expectations of higher survival rate of cancer patients. In addition, prognosis for cancer prevalence and cancer incidence were used to calculate the needed number of LIN for the year 2015, 2020 and 2030 for Austria and Vienna.

Results: There is a need for minimum 61 LIN and maximum 86 LIN and present which implies a discrepancy of 18 LIN for the whole country (actual 43 LIN) for 2015. Based on the prognosis for cancer incidence a discrepancy of 14 LIN for Austria (aim 57 LIN) exists for 2015. The cancer prevalence prognosis shows a need for 68 LIN, which is a discrepancy of 25 LIN for the year 2015. For the city of Vienna, the actual situation (12 LIN) seems appropriate, as the discrepancy for 2015 is only 1 LIN. There is one important extra factor for Vienna: about 20% of all treated cancer patient come from Austrian neighbour districts, therefore there is a growing waiting list in Vienna. The entire prognosis until 2030 are general worse, because the results shows 2.01 mill inhabitants and around 8900 new cancer cases gives a need of 16 LIN for Vienna.

Conclusion: There is a minimum discrepancy of 18 LIN for the whole country for 2015. One important factor for precise planning the resources in radiotherapy is the cancer prevalence. Based on the prognosis model with the cancer prevalence is an actual need of 25 LIN for whole Austria and one more in Vienna. To fulfil the constitutional law obligations, the government should immediately start to close the gap of minimum 18 LIN for the whole country. Austria will have in 15 years a shortage of 40 LIN (aim 73 LIN) and this will have a negative impact on waiting time and outcomes of the treatments. Never less in these calculations is not the included the different complexity of treatments in radiotherapy which need different recourses of time, staffing and equipment. A further project should implement these factors to get a much more tailored planning for the formal recommended radiotherapy resources in Austria. .

Symposium: Combining radiotherapy with molecular targeted agents: learning from successes and failures

SP-0603
Interaction of radiotherapy with molecular targeting agents

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Despite the well established role of radiation in the treatment of solid tumor malignancies, and the rapidly expanding cadre of promising molecular targeting agents in oncology, the systematic investigation of radiation combined with molecular agents remains in an early dawn period. The increased precision of modern day radiation delivery to tumor targets with diminished dose exposure to normal tissues lends itself very favorably to combination with systemic therapies, particularly those tailored to specific molecular tumor targets. The complementary strengths of highly conformal radiation with molecular targeting agents affords a powerful opportunity to advance precision cancer medicine to a new level of impact for the future.
In this presentation, we will review the rationale for combining radiation with molecular targeting agents and consider opportunities for systematic study in both the preclinical and clinical trials setting. Several major clinical trials that examine this combination will be presented and discussed to highlight current findings and future opportunities. Strategies to expand the investigation of radiation/molecular target combination studies will be previewed. In both the curative and palliative oncology setting, it is possible that some of the most compelling opportunities for improvement in cancer patient outcomes for the future may derive from combinations of radiation with molecular targeting agents.

SP-0604
Challenges combining radiotherapy with immunotherapy

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Both preclinical studies and case reports have described synergistic interactions between local radiation (RT) and different types of cancer immunotherapy, demonstrating the potential for the combination to enhance locoregional efficacy and, by inducing an effective immune response reflect in systemic control. The latter effect, defined as "abscopal" is particularly relevant, since it has re-positioned classical radiotherapy into a treatment modality with systemic effects (1, 2). Our group described a role for RT in enhancing T cell activation and proliferation via antigen cross-presentation in the draining lymph node when combined with a diverse array of immune strategy, including enhancers of the priming phase (Flt-3L, GM-CSF, TLR agonists) or the effector phase (blocking CTLA4, PD-1, or TGF-beta) (3-8). Specifically, when combined with anti-CTLA-4 we demonstrated mechanisms underlying the abscopal effect, including enhanced T cell homing through release of CXCL16 and enhancement of the immunological synapse by release of RAE, the ligand for NKG2D receptor (7,8). We further demonstrated the clonal diversity of T cell immune responses induced by RT alone and RT combined with ipilimumab in patients with metastatic non small cell lung cancer refractory to other treatments, and are currently working at detecting the specific antigens responsible for the immune response to the combination (unpublished data).
However, many challenges remain to best optimize radiation in the context of cancer immunotherapy, both in terms of the choice of dose and fractionation when radiation is combined with immunotherapy as well as how to best block the immunosuppressive effects that accompany the immunogenic properties of radiation.
While we have demonstrated that when combined with anti CTLA-4 radiation best work when hypo-fractionated, it remains unclear whether ablative doses are necessary to sustain this effect (9). Similarly, when radiotherapy is combined with both CTLA-4 and PD- blockade the optimal scheduling remain unknown. Because of the immune-privilege status of established tumors, it is likely for multiple strategies to be necessary to subvert this condition (10). Ideally a rseries of well orchestrated interventions should result in release of neo-antigens, increased permeability of the tumor to enhance access to antigen presenting cells and increased cross presentation (potentially with the addition of TLR agonists). The ensuing effector phase requires the availability of a sufficient number of T lymphocytes, a variable that can be assessed by measuring in the peripheral blood the ratio between neutrophils and lymphocytes (11). Blockade of immune checkpoints is also required to develop and sustain a robust effector response. The concurrent interplay of macrophages is crucial for each of the steps described (12). While preclinical evidence for the therapeutic advantage of reverting macrophage polarization from M2 to M1 is emerging, how to optimally combine radiotherapy remains elusive. Experiments of low dose radiation inducing M1 polarization and recovering response to immune checkpoint blockade are being translated to the clinic (13). Strategies to overcome the immunosuppressive effects of RT have also evolved from preclinical to clinical setting. For instance to overcome RT-induced activation of TGFbeta, the need for additional PD-1 blockade has emerged, and it warrants clinical testing (6). A general barrier to advance the field consists of the complexity of testing multiple immunotherapy agents, often provided by different pharmaceutical companies. While radiation is a standard modality, with well-established, organ-specific acute and longterm toxicities, its use in combination with each immunotherapy agent obeys standard clinical trials safety and feasibility rules, and the pace of clinical testing. To this

regard reliable biomarkers of response, ideally to be used as early surrogate endpoints for assessing response are much needed. Our results suggest that as early as at a three weeks interval from RT and ipilimumab, peripheral blood markers predict for development of a clinical objective response to the combination.

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SP-0605
New strategies to targeting tumour angiogenesis and hypoxia
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Abstract not received

Symposium with Proffered Papers: Radiomics - the future of radiotherapy?

SP-0606
Imaging-genomics: identifying molecular phenotypes by integrating radiomics and genomics data

To be confirmed

SP-0607
PET/CT heterogeneity quantification through texture analysis: potential role for prognostic and predictive models
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The use of PET/CT has increased much in the last decade, from a purely diagnostic to a radiotherapy planning and therapy monitoring tool. For these new applications, the quantitative and objective exploitation of PET/CT datasets becomes crucial given the well-established limitations of visual and manual analysis. Within this context, the Radiomics approach which consists in extracting large amount of information from multimodal images relies on a complex pipeline: image pre-processing, tumor segmentation, image analysis for shape and heterogeneity features calculation, and machine learning for robust and reliable features selection, ranking and combination with respect to a clinical endpoint. Although the Radiomics approach has been extensively applied to CT imaging, its use for PET/CT is more recent and less mature. There are however already a large body of published works hinting at the potential value of textural features and other advanced image features extracted from PET/CT in numerous tumour types. However, many methodological issues and limitations specific to PET/CT image properties have been highlighted by recent studies, This presentation aims at presenting both the promises and potential of advanced PET/CT image textural features analysis to build prognostic and predictive models, as well as the numerous pitfalls to avoid in order to further advance research in that promising field.

SP-0608
The potential of radiomics for radiotherapy individualisation
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In the era of tailored medicine, the field of radiation oncology aims at identifying patients likely to benefit from treatment intensification and of those suffering from undesired treatment-related side-effects. In the past, patient selection in oncology was merely based on, e.g., randomisation, immunohistochemical staining of tumour biopsies, on tumour size or stage, or even on preferences. The introduction and increased availability of high-throughput techniques, such as genomics, metabolomics and Next Generation Sequencing, have revolutionised the field.
In radiation oncology, high-quality anatomical and functional imaging is, besides physical examination, the pillar for target-volume delineation, planning and response assessment. Therefore, 'radiomics', referring to the comprehensive quantification of tumour phenotypes through extensive image features analyses, is a logical consequence. Pioneered by the publication of Aerts *et al*. [1], the field is rapidly evolving regarding techniques, tumour sites and imaging modalities assessed.
In this presentation, the status of radiomics for radiotherapy individualisation will be highlighted and possible areas of future research activities outlined.
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OC-0609
Radiomic CT features for evaluation of EGFR and KRAS mutation status in patients with advanced NSCLC
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Purpose or Objective: Molecular profiling is considered standard of care for advanced non-small cell lung cancer (NSCLC) patients. Approximately 25% of adenocarcinoma patients has a *KRAS* mutation; 10-15% has an activating *EGFR* mutation where tyrosine kinase inhibitors (TKI) are approved for first line treatment. *EGFR* and *KRAS* mutations are mutually exclusive. Obtaining enough tissue for molecular analysis may be difficult. Therefore, in this study we investigated whether *EGFR* and *KRAS* mutations can be distinguished from wildtype patients based on features derived from standard CT imaging.

Material and Methods: From a retrospective database of NSCLC patients included between 2004 and 2014, all *EGFR*-mutated (*EGFR*+, only exon 19 deletions or exon 21 L858R) patients, the consecutive *KRAS*-mutated (*KRAS*+) and *EGFR*/*KRAS* wildtype (WT) patients were included. The CT-scan at first diagnosis of NSCLC (i.e. before any treatment) with the primary tumor visible was used for radiomics feature extraction. The primary tumor was delineated using a GrowCut segmentation algorithm (3D Slicer) and manually